

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



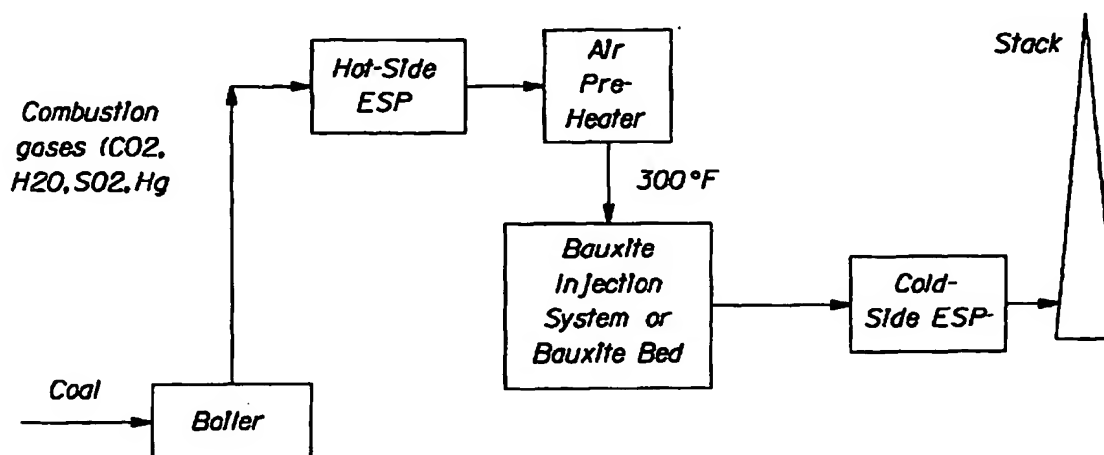
(43) International Publication Date  
25 September 2003 (25.09.2003)

PCT

(10) International Publication Number  
**WO 2003/078030 A3**

- (51) International Patent Classification<sup>7</sup>: **B01D 53/64**, B01J 20/08, C02F 1/28, B01D 15/00, A61L 2/16, 2/23, 9/16, B09C 1/08, B01D 53/54
- (21) International Application Number: PCT/US2003/007631
- (22) International Filing Date: 12 March 2003 (12.03.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/363,693 12 March 2002 (12.03.2002) US  
60/396,526 17 July 2002 (17.07.2002) US
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:  
— with international search report
- (88) Date of publication of the international search report:  
5 February 2004
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TREATMENT OF ENVIRONMENTAL POLLUTANTS WITH MINERAL ORES



(57) Abstract: A method for removing a pollutant from emissions or the environment comprising: contacting a mineral ore or the use of a mineral ore selected from the group consisting of bauxite, modified bauxite and mixtures thereof. Typically, the pollutant is a heavy metal or a microorganism.

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 03/07631

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B01D53/64 B01J20/08 C02F1/28 B01D15/00 A61L2/16  
A61L2/23 A61L9/16 B09C1/08 B01D53/34

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D B01J C02F A61L B09C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 45 191 A (FTU GMBH FORSCHUNG UND TECH EN) 15 April 1999 (1999-04-15) column 1, line 3 -column 3, line 56; claims 1,5,11,14	1-5,7-9
X	DE 199 36 930 A (FTU GMBH FORSCHUNG UND ENTWICK) 8 February 2001 (2001-02-08) the whole document	1-5,7-9
X	US 5 245 106 A (VARIN PHILIPPE ET AL) 14 September 1993 (1993-09-14) column 1, line 8 -column 2, line 21; claim 1	1,2,4,5
A	US 2 391 116 A (ASHLEY KENNETH D) 18 December 1945 (1945-12-18) page 1, column 1, line 49 -page 1, column 2, line 7; claims 1-10	3
-/-		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
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- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

17 September 2003

Date of mailing of the international search report

02.10.03

Name and mailing address of the ISA

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de Biasio, A

# INTERNATIONAL SEARCH REPORT

Inter Application No

PCT/US 03/07631

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 378 451 A (DU PONT CANADA) 27 December 1974 (1974-12-27) page 1, line 25-63; claims 1,2 ---	1,3-9
X	US 5 490 907 A (WEINWURM PAUL S ET AL) 13 February 1996 (1996-02-13) column 1, line 62 -column 3, line 33 ---	1,6,9
X	US 5 387 738 A (BECKHAM DOYLE H ET AL) 7 February 1995 (1995-02-07) column 4, line 3-65; claims 7,24 ---	1,6,9
X	US 6 030 537 A (GREENE ARTHUR F ET AL) 29 February 2000 (2000-02-29) claim 1 ---	1,6,9 3
X	DE 40 25 778 A (NALCO CHEMICAL CO) 20 February 1992 (1992-02-20) claims 11,13 ---	1,6 3,7-9
X	US 6 207 059 B1 (MOORE III GEORGE A) 27 March 2001 (2001-03-27) the whole document ---	1,3,6,9, 10
X	US 6 333 004 B1 (SHELDON DAN M) 25 December 2001 (2001-12-25) paragraph '0008!; claims 1,6,7 ---	10
X	US 2001/042719 A1 (LEVY EHUD) 22 November 2001 (2001-11-22) paragraph '0011! ---	10
X	US 4 184 947 A (DEMISCH RONALD R) 22 January 1980 (1980-01-22) column 2, line 15-45 ---	10
X	GUPTA S K ET AL: "ARSENIC REMOVAL BY ADSORPTION" JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, WATER POLLUTION CONTROL FEDERATION. WASHINGTON, US, vol. 50, no. 3, 1 March 1978 (1978-03-01), pages 493-506, XP002045849 the whole document ---	1,3,6,9
X	US 5 719 099 A (BHAT VASANTH K) 17 February 1998 (1998-02-17) column 1, line 10-22; claim 1 ---	1,6,9

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 03/07631

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 2  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 2

Present claim 2 relates to an extremely large number of possible pollutants. In fact, claim 2 contains so many options, variables, possible permutations and provisos that a lack of clarity (and/or conciseness) within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claims impossible. Consequently, the search has been carried out for those parts of the application which do appear to be clear (and/or concise), namely claims 1,3-5,7-9 as far as removal of heavy metals from gases is concerned (Claim 6 has not been searched because of a lack of unity).

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1,3-5,7-9 (all partially)

The first subject-matter defined in claim 1 is a process for removing heavy metals from a gas by contacting said gas with bauxite or modified bauxite.

2. Claims: 1,3,6-9 (all partially)

A second subject-matter defined in claim 1 is a process for removing heavy metals from water by contacting said water with bauxite or modified bauxite.

3. Claims: 1,3,6-9 (all partially)

A third subject-matter defined in claim 1 is a process for removing heavy metals from soil by contacting said soil with bauxite or modified bauxite.

4. Claim : 10

Process for removing or inactivating microorganisms in an emission or in the environment by contacting the microorganism with a mineral selected from bauxite, copper ores and mixtures thereof.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Intel. Application No

PCT/US 03/07631

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 19745191	A	15-04-1999	DE 19745191 A1	15-04-1999
			WO 9919051 A1	22-04-1999
DE 19936930	A	08-02-2001	DE 19939382 A1	19-04-2001
			DE 19936930 A1	08-02-2001
US 5245106	A	14-09-1993	FR 2668465 A1	30-04-1992
			AU 648119 B2	14-04-1994
			AU 8683791 A	28-01-1993
			CN 1356267 A	03-07-2002
			CN 1062301 A , B	01-07-1992
			DE 69119541 D1	20-06-1996
			DE 69119541 T2	28-11-1996
			DE 69133104 D1	17-10-2002
			DE 69133104 T2	27-02-2003
			EP 0484234 A2	06-05-1992
			EP 0628337 A1	14-12-1994
			ES 2090276 T3	16-10-1996
			ES 2183820 T3	01-04-2003
			JP 3194095 B2	30-07-2001
			JP 4281841 A	07-10-1992
US 2391116	A	18-12-1945	NONE	
GB 1378451	A	27-12-1974	CA 991627 A1	22-06-1976
			DE 2218159 A1	26-10-1972
US 5490907	A	13-02-1996	US 5087375 A	11-02-1992
US 5387738	A	07-02-1995	WO 9624442 A1	15-08-1996
US 6030537	A	29-02-2000	AU 3738797 A	25-02-1998
			WO 9805593 A1	12-02-1998
DE 4025778	A	20-02-1992	DE 3904575 A1	16-08-1990
			DE 4025778 A1	20-02-1992
			AT 77607 T	15-07-1992
			DE 59000174 D1	30-07-1992
			EP 0383156 A1	22-08-1990
			ES 2033145 T3	01-03-1993
			GR 3005023 T3	24-05-1993
			HU 69126 A2	28-08-1995
			RU 2034795 C1	10-05-1995
			YU 29490 A1	31-08-1991
US 6207059	B1	27-03-2001	NONE	
US 6333004	B1	25-12-2001	US 2002102180 A1	01-08-2002
			US 2002192812 A1	19-12-2002
US 2001042719	A1	22-11-2001	US 2002195407 A1	26-12-2002
			US 6241893 B1	05-06-2001
			WO 02053262 A1	11-07-2002
			AU 5574301 A	12-11-2001
			WO 0183376 A2	08-11-2001
			US 2003038089 A1	27-02-2003
US 4184947	A	22-01-1980	NONE	

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Int: 18 Application No

PCT/US 03/07631

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 5719099	A	17-02-1998	US 6313368 B1	06-11-2001
			US 6388165 B1	14-05-2002
			US 5985778 A	16-11-1999
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